

### **III. Population Factors**

Humans are the only natural hosts for the syphilis-causing spirochete. Except for intrauterine infection, syphilis is transmitted by sexual contact between infected and uninfected epithelial surfaces (2). Therefore, population characteristics and population dynamics play an important role in a syphilis epidemic. Population factors may not be the direct cause of syphilis transmission, however, certain social environments and sub-population groups are more favorable for syphilis spreading.

#### **A. Methods**

Relevant literature and government documents were searched and reviewed. A local homeless service agency's data, and local behavior risk factor survey data were obtained and analyzed. Findings are summarized as follows.

#### **B. Findings**

Literature defined "syphilis core groups" as those socio-sexual networks that contribute a disproportionate share to sustaining syphilis rates in communities. A small number of "core transmitters" can lead to rapid increases in the level of infection in a community if there is the "right" socio-sexual network. The syphilis reproduction model and empirical data suggest that syphilis core transmitters will need higher rates of sex partner change than other STDs to maintain the infection within their sexual network. In other words, the "right" socio-sexual network consists of a small group of core transmitters, a large number of sexual partners, and a much larger group of persons who have moderate risky sexual behavior (e.g., two to four sex partners per year) (22, 23).

Studies identified that common characteristics of STD core transmitters may include urban residence, low socio-economic status, age between 15 and 30, and membership in an ethnic or racial minority population. Because the core is not a closed population, its members are also responsible for infection outside the core. The mixing of core and non-core members facilitates transmission of STDs to the wider pool of partners in the general population (4). A syphilis outbreak investigation discovered that the outbreak consisted of 10 syphilis cases but involved a substantial number of people (99 people) who interacted sexually on a regular basis. Those with syphilis had an average of 7.4 sex partners (range 3-16) (24). As mentioned in the "biological factors" section, among couples with frequent sexual contact, four out of five partners exposed to the infectious lesions of early syphilis were infected (22). Therefore, the population factors of core group existence and sex partner mixing are some of the most important factors relating to the syphilis epidemic.

##### **1. General Population**

Syphilis-favored sub-population groups will not exist in isolation. The example of such a group is described in the previous paragraph. The existence of a syphilis-favored sub-population group requires general population basis with certain population factors.

Analysis of Nashville's general population suggests that the following population factors may offer a basis for the existence of syphilis favored sub-population group.

a. The high percentage of poverty in the population

According to the Tennessee State Data Center, as of 1993, 17.9% of Davidson County residents are living in poverty. Even higher is the percentage of school-aged children living in poverty in Davidson County, 27.3% (25). It is well documented that syphilis is more prevalent in the United States among the poorly educated and economically deprived than more prosperous groups (26).

b. The increasing trend in crime

Crime in Nashville has increased during the last two decades. In 1996, Nashville ranked 7<sup>th</sup> in crime, compared nationally to 24 comparable cities, up from 27<sup>th</sup> in 1985 (27). According to an article in December 2000 *Tennessean*, "Despite reports of a national decline in cocaine use, Metro police officials and those who treat people with drug problems say use of the drug – in all of its forms- remains steady in Music city and is fueling much of Nashville's crime." (28). One of the postulated causes for a recent epidemic of syphilis in the United States was urban decay, resulting in an environment of increasing crime, violence, and dysfunctional families (3). Data from this investigation provided solid evidence regarding the linkage between syphilis cases and criminal activities. As noted in the previous section, syphilis cases had a higher percentage of criminal arrests on charges of sex or drug related offenses.

c. A relatively higher percentage of females in the population

Females comprise 51.6% of the Nashville population and 50.9% in the United States according to 2000 census data (29). If we use U.S. female population percentage as a benchmark for comparison, the percentage difference between Nashville's female and U.S. female ( $51.6\% - 50.9\% = 0.7\%$ ) suggest that Nashville will have 3,030 more females aged 10-64 and proportionally less males aged 10-64 than other U.S. cities with same population. This may have been associated with a low availability of the pool of low risk heterosexual male partners and a relatively higher proportion of a vulnerable population segment (young women and female adolescents are more easily infected than men) (3, 8).

d. Fast growth of the Nashville MSA population

Nashville Metropolitan Statistical Area<sup>11</sup> (MSA) is the second fastest growing MSA in Tennessee with 15.2% population growth during 1990-1997, making it the largest MSA in the state (25). This may introduce some high risk group members from outside of Davidson County. The MHD STD program staff observed an increasing number of syphilis contacts from Nashville's surrounding counties during the last few years (31). Although there is no data to show that the surrounding counties had higher rates of syphilis than Nashville, it may indicate that Nashville is becoming the center of a social sex network favorable for syphilis transmission. It may also bring new sources of infection to the Nashville population.

2. Homeless Population

Another important population factor is the stable number of diversified homeless persons in this community. The homeless reflect several sub-population groups whose relative proportion may vary regionally across the country. These groups may include single-parent households, single men, single women, individuals with serious disabilities, severe mental illness, or long-standing substance abuse problems, ex-offenders released from jail or prison, homeless youth, and others (32). Studies suggest that males make up about 70% of the adult homeless population (33).

Runaways and homeless adolescents are at an increased risk of STDs because they tend to be more sexually active than other adolescents; have multiple high-risk sexual behaviors including trading sex for drugs or money; have high levels of substance abuse; and are frequently sexually and physically abused by others (8). A recent MHD survey of the homeless in Nashville found that 6% of the homeless people surveyed have HIV/AIDS (34).

A 1993 survey of 37 homeless females by the Family Life Center (FLC) in Nashville found that 31% of them had been treated for STDs, 22% of them had traded sex for a place to stay, 11% of them had traded sex for drugs, 8% of them had traded sex for money (35).

We conducted a matched analysis of homeless persons who were served by the FLC. The analysis identified 18 confirmed syphilis cases among 4,359 homeless females during 1995-1998, yielding an average annual incidence of 412.9 per 100,000 during the period. This incidence is more than 14 times the average female syphilis

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<sup>11</sup> Metropolitan Statistical Area (MSA) is a core area containing a large population nucleus, which includes adjacent communities that have a high degree of economic and social integration with that core. Standard definition of metropolitan areas were first issued in 1949 by the Bureau of the Budget (now, the United States Office of Management and Budget), under the designation "standard metropolitan area" (SMA). The term was changed to "standard metropolitan statistical area" (SMSA) in 1959, and to "metropolitan statistical area" (MSA) in 1983. The current standards provide that each newly qualifying MSA must include at least one city with 50,000 or more inhabitants, or a Census Bureau-defined urbanized area (of at least 50,000 inhabitants), and a total metropolitan population of at least 100,000 (75,000 in New England) (30).

incidence in Nashville and almost 13 times the average syphilis incidence of Nashville's total population during the same period (1995-1998) (Table 13).

Table 13. Number and Incidence of P & S Syphilis at Family Life Center (FLC) Homeless Female Population in Comparison to Nashville's Total and Female Syphilis Rate, 1995-1998

	1995	1996	1997	1998	Average
# of Syphilis Cases in FLC	2	7	4	5	4.5
# of Homeless Female	1,148	1,024	1,075	1,112	1,089.75
Homeless Female Incidence*	174.2	683.6	372.1	449.6	412.9**
Nashville Female Rate*	15.3	34.4	34.5	32.4	29.2
Nashville Total Rate*	18.2	36.1	38.0	38.5	32.7

\*Incidence rate per 100,000 persons. \*\*Average incidence rate was calculated by 4.5/1089.75 or 18/4359. Averaging 1995 to 1998 homeless female incidence will produce a slightly different rate due to rounding.

A further analysis of 1995 homeless females at the FLC matched with Nashville's STD data yields 41 confirmed STD cases, a rate of 3,571.4 per 100,000 female population. This is four times higher than Nashville's overall STD female incidence rate. (In 1995, Nashville's STD incidence<sup>12</sup> was 908.4 per 100,000 female population).

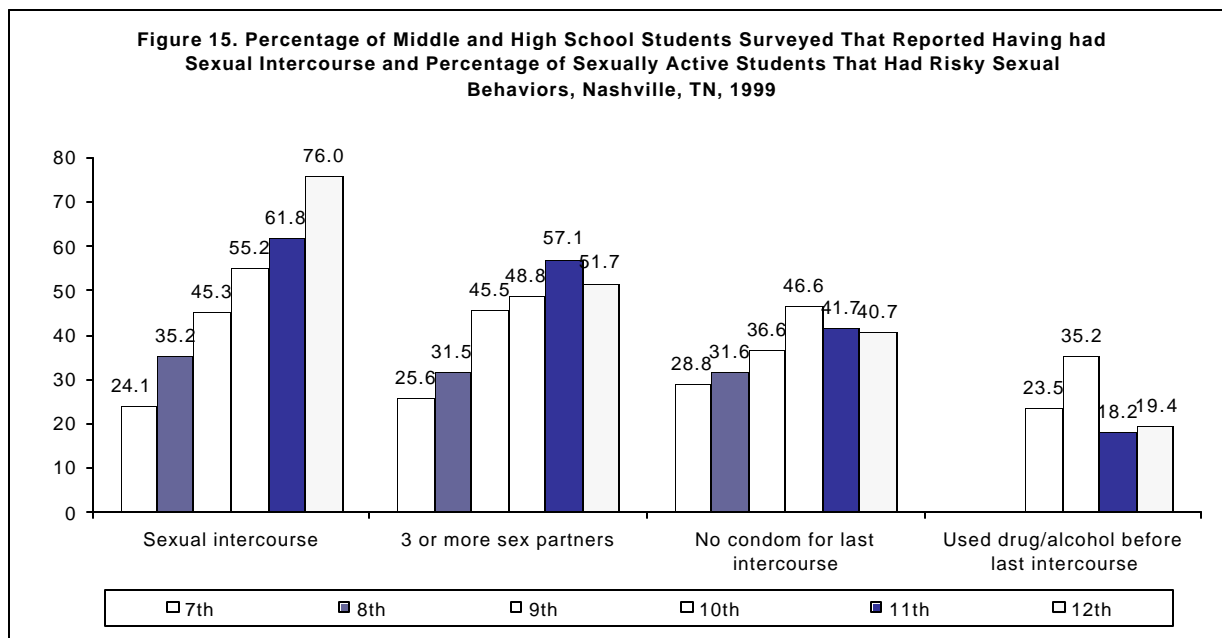
### 3. Population's Sexual Behavior

Certain sexual behaviors place individuals at greater risk of acquiring or transmitting syphilis. A recently released publication by the MHD Division of Epidemiology examined MHD regularly collected STD surveillance data and behavior risk factor data from three risk behavior surveys conducted in Nashville during 1998-1999 (36). The relevant findings are summarized as follows.

- ? Sexual debut: The average age of initiation for sexually active 7<sup>th</sup> and 8<sup>th</sup> graders surveyed was reported to be 11 years old. For 9<sup>th</sup> and 10<sup>th</sup> grades, initiation was reported at age 13, and for 11<sup>th</sup> and 12<sup>th</sup> grades, at age 14.
- ? Sexual experience: Almost one-fourth (24.1%) of 7<sup>th</sup> graders and more than one-third (35.2%) of 8<sup>th</sup> graders surveyed had had sexual intercourse. Almost one-half (45.3%) of 9<sup>th</sup> graders, more than one-half (55.2%) of 10<sup>th</sup> graders, almost two-thirds (61.8%) of 11<sup>th</sup> graders, and more than three quarters of (76.0%) 12<sup>th</sup> graders reported having had sexual intercourse (Figure 15).

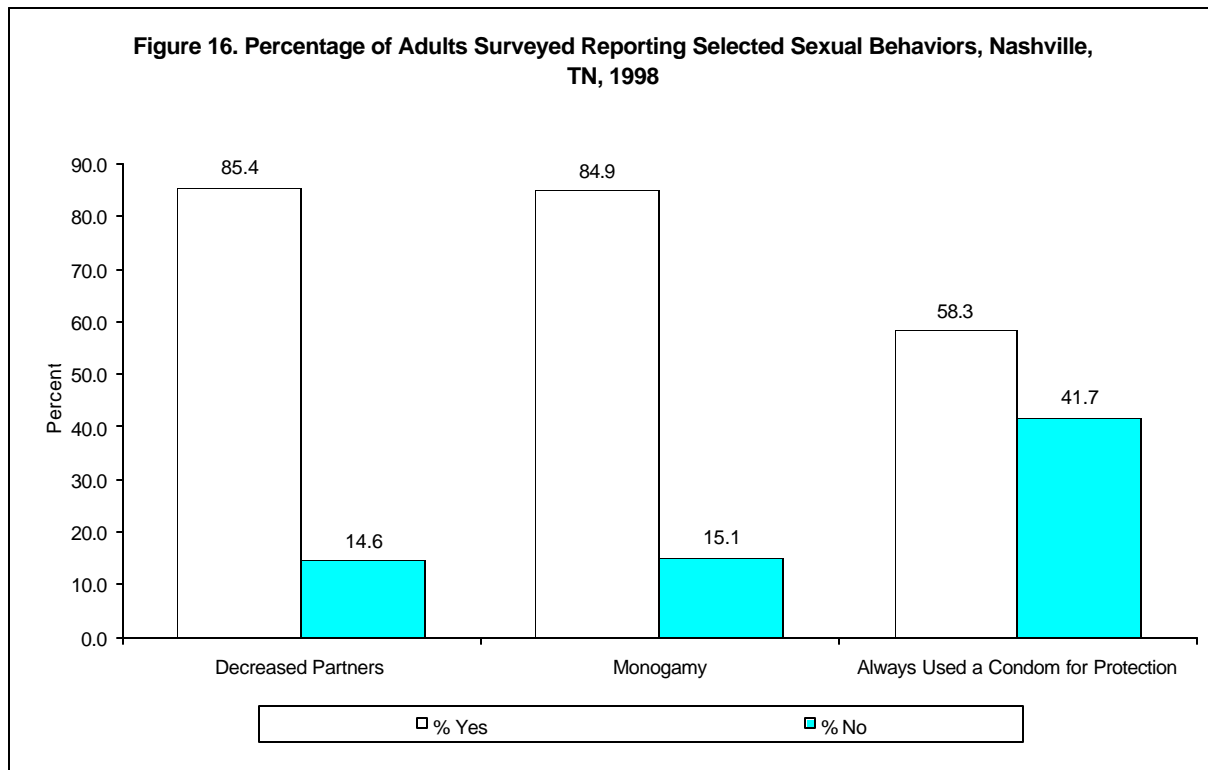
<sup>12</sup> STD incidence is calculated using the formula: STD incidence = the sum of all reported STD cases (syphilis, gonorrhea, and chlamydia)/residential population of the area of study x 100,000.





- ? Multiple sexual partners: Among the sexually active middle and high school students surveyed, 25.6% of 7<sup>th</sup> graders, 31.5% of 8<sup>th</sup> graders, 45.5% of 9<sup>th</sup> graders, 48.8% of 10<sup>th</sup> graders, 57.1% of 11<sup>th</sup> graders, and 51.7% of 12<sup>th</sup> graders reported having had 3 or more sexual partners (Figure 15).
- ? Use of a condom: The percentages of middle and high school students surveyed who did not use a condom the last time they had intercourse were noticeably high. From 7<sup>th</sup> to 12<sup>th</sup> graders the percentages were 28.8%, 31.6%, 36.6%, 46.6%, 41.7%, and 40.7% respectively (Figure 15).
- ? Use of alcohol and/or drugs before sexual intercourse: Almost a quarter (23.5%) of 9<sup>th</sup> graders, more than one-third (35.2%) of 10<sup>th</sup> graders, 18.2% of 11<sup>th</sup> graders, and 19.4% of 12<sup>th</sup> graders reported having used alcohol and/or drugs before sexual intercourse (Figure 15).
- ? Number of partners and condom use in adults: Among adults surveyed, 14.6% reported not reducing their number of partners in the past 12 months, 15.1% reported not being monogamous, and 41.7% reported not using condoms (Figure 16).

? Reported STD cases: Locally, there were 21,988 STDs reported in the 5-year period covering 1995-1999. Of these, 36.1% were diagnosed at the STD specialty clinic located at the MHD Lentz Public Health Center.



### C. Discussion

The dynamic of Nashville's population provides a necessary social environment for syphilis transmission when a syphilis core group is available. A sample of the female homeless population data above and TennCare utilization data (discussed in the next section on pages 42-51) suggest that the syphilis core groups may be available in Nashville.

The female homeless study findings reveal an alarmingly high syphilis incidence among the sample of female homeless individuals. Coupled with previous research findings that the homeless population tends to have multiple high-risk sexual behaviors, the syphilis cases in the homeless population in Nashville probably contribute to "core transmitter" groups in the community. A recent screening at the Downtown Clinic for the homeless did not yield many syphilis cases and a screening conducted during the May 1999 blitz at the Family Life Center failed to identify any new syphilis cases. However, the screenings can not rule out the possibility of syphilis cases in the homeless population as one of the contributors to the core group since both screenings were a one-time action, not a part of systematic on-going screening effort with this relatively mobile sub-population.

While the female homeless matched study is based on just one homeless service program's data and syphilis numbers are small and are subject to random variation, according to the FLC program administrator, this is the largest female homeless service program in Nashville. Many street people may not come to this service. It is known that homeless males and homeless people who do not use shelter services tend to engage in more risky behaviors such as drug use and sex for money and drugs (37). Therefore, it is reasonable to assume the convenience sample data used here reflects an underestimation of the situation. A well designed, systematic syphilis screening program is needed to find out if syphilis cases in the homeless population are contributing to Nashville's syphilis core groups.

When the syphilis core groups are available in a community, the only other condition required for an epidemic to occur is a vulnerable population with high risk sexual behaviors. As documented in the local behavior risk factors surveys, there is a higher proportion<sup>13</sup> of Nashville's youth and adults engaged in risky sexual behaviors suggesting that a favorable population base exists in the community for the syphilis epidemic. Combined with other factors examined in the report that may contribute to the epidemic, it is clear that Nashville has soil, seed, and a desired environment for a syphilis epidemic to occur.

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<sup>13</sup> A larger percent of Nashville students (12%) in 1999 reported having sexual intercourse for the first time before age 13 than did students in the U.S. (7%) in 1997 and in Tennessee (10%) in 1999. A larger percentage of Nashville students (59%) in 1999 reported ever having sexual intercourse than did students in the U.S. (48%) in 1997 and in Tennessee (50%) in 1999. A larger percent of Nashville students (21%) in 1999 reported having sexual intercourse with 4 or more people during their life than did students in the U.S. (16%) in 1997 and in Tennessee (18%) in 1999. A larger percent of Nashville students (40%) in 1999 reported having had sexual intercourse during the past three months than did students in the U.S. (35%) in 1997 and in Tennessee (38%) in 1999 (38).

#### **IV. Health Care System Issues**

Two health care system issues discussed here may contribute to the syphilis epidemic in Nashville. They are: 1) access to health care, and 2) the syphilis surveillance system: underreporting and/or miscoding and/or misdiagnosis

##### **A. Access to Health Care**

Providing proper diagnosis and treatment is critical to syphilis control. Inadequate access to health care may lead to a delay in diagnosis and treatment, which may increase the likelihood of syphilis transmission.

The most notable recent event that influenced health care access in Tennessee was the introduction of TennCare. TennCare replaced Tennessee's Medicaid Program in 1994. It is also the State's health insurance program for the underinsured and uninsured. The budget is \$4.3 billion. Of which \$1.4 billion comes from the state and \$2.9 billion from matching federal funds. TennCare's budget represents 26% of the State of Tennessee's budget. Currently, 1.4 million people, one-fourth of all Tennesseans, are being served by TennCare, including the 900,000 who would have been eligible for Medicaid (39).

The introduction of TennCare may act in two opposing ways. Many additional individuals (36% of the TennCare population) who were considered uninsured or uninsurable now have coverage, and this should act to improve access to care.

However, those patients who were covered under the traditional Medicaid Program (64% of TennCare population) may now have fewer choices for primary care physicians since the current system operates much like a Health Maintenance Organization (HMO) and will only cover care received from a network provider. If the patient is not pleased with the care received within the network, some conditions such as an STD may remain untreated and ultimately contribute to the syphilis epidemic (7). By receiving care from assigned network providers, clinical skill utilization and reporting differentials may have been introduced.

The staff of the STD/HIV Program at the Metro Health Department report that disease investigation is often more difficult since they try to acquire the private provider's permission to follow up with their patients who may have an STD. This may have some negative impact on contact tracing and partner notification, reducing the effectiveness of the control effort. Historically, patients presented themselves to health departments or even emergency rooms for STD services. However, TennCare requires the individuals go to their assigned primary health care provider in order to receive health services, which causes an added delay in follow-up with those patients who are reported as having an STD. Furthermore, it is possible that private physicians may be treating patients with STDs, but not following up with their sexual partners (40).

One study documented that nine states and cities reported problems with syphilis care provided in the private sector, including repeated errors in diagnosis and classification of patients and failure to treat diagnosed patients. In addition, the gender, race, and culture of most providers is different from that of their clients (40). Literature has provided much evidence that medical/sexual history taking and preventive counseling are substantially more effective when the provider and client are of the same race-culture and gender (40). When this is not the case, it has a negative impact not only on the effectiveness of syphilis care, but also on syphilis patients' health care seeking behaviors.

TennCare changed the dynamics of access to syphilis care in this community. It also provided an opportunity for a new avenue for enhancing the syphilis surveillance system. Our investigation reveals some facts related to the syphilis surveillance system and/or the quality of syphilis care, which will be discussed in the next section.

## B. Underreporting and/or Miscoding and/or Misdiagnosis

The syphilis surveillance system, like other notifiable disease surveillance systems, is far from perfect. Underreporting and/or miscoding and/or misdiagnosis will have a negative impact on the effectiveness and efficiency of the syphilis surveillance system, and will consequently, directly or indirectly, contribute to the syphilis epidemic. Using MHD syphilis surveillance data and TennCare utilization data, we examined the underreporting and/or miscoding and/or misdiagnosis issue. The results are presented below.

### 1. Methods

1994-1998 TennCare utilization data (ICD-9 code 091.0 to 091.9, primary and secondary syphilis) were obtained from the Bureau of TennCare. The data were first tabulated using a SAS program; then, TennCare patients with ICD diagnosis codes of P & S syphilis were matched with 1994-1998 MHD syphilis cases by name, race, and date of birth using a Microsoft Excel Program. The matched results were analyzed. To validate the matching results, MHD STD clinic staff were consulted and related syphilis case charts were audited.

### 2. Findings

#### a. Overview

During 1994-1998, TennCare providers submitted invoices to TennCare for reimbursement of services provided to 348 Davidson County residents with diagnosis codes of primary and secondary syphilis. These 348 TennCare provider diagnosed

primary and secondary syphilis patients<sup>14</sup> made 373 visits. Of these 348 primary and secondary syphilis patients, 312 patients (89.7%) were not matched (hereafter referred to as “unmatched”) with MHD reported P & S syphilis cases (hereafter referred to as “reported”). Of the 312 unmatched patients, 12.8% were diagnosed as primary syphilis, 87.2% were diagnosed as secondary syphilis. On average, TennCare providers diagnosed 62 P & S syphilis patients per year that were not in the MHD syphilis surveillance system during 1994-1998 (Table 14).

Table 14. Number of TennCare Diagnosed P & S Syphilis Patients, Number of the Patients Matched and Unmatched to the Reported Cases, and Number of Reported Cases, Nashville, TN, 1994-1998

	# of Visits due to P & S Syphilis	# of TennCare Diagnosed P & S Syphilis patients	# of TennCare P & S Syphilis Matched to the Reported Cases	# of TennCare P & S Syphilis Patients Not Matched to the Reported Cases (Unmatched)	% of TennCare P & S Syphilis patients Unmatched	# of P & S Syphilis Cases Reported to MHD
1994	60	52	3	49	94.2	100
1995	100	83	3	80	96.4	97
1996	105	105	12	93	88.6	193
1997	70	70	10	60	85.7	203
1998	38	38	8	30	78.9	210
Total	373	348	36	312	89.7	803

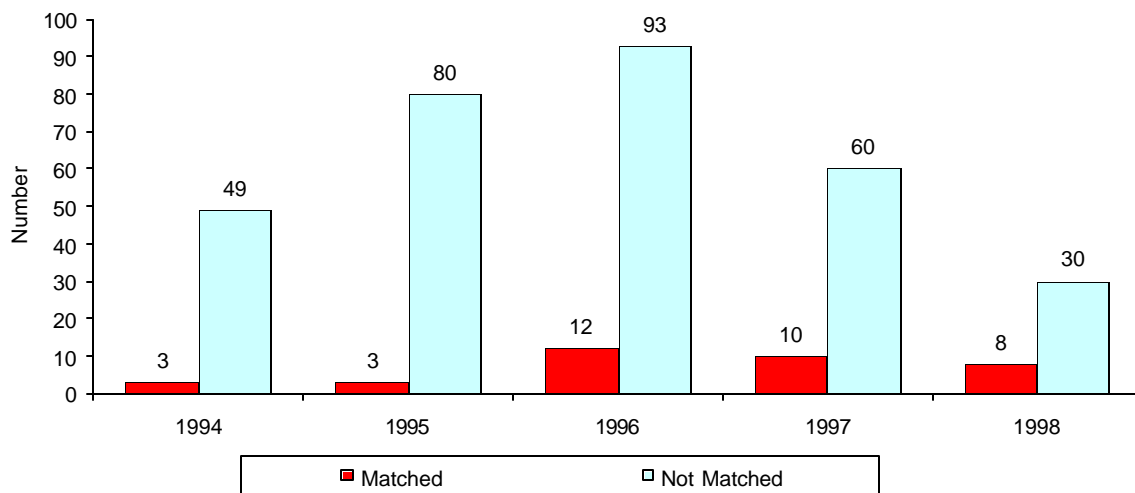
b. Demographic characteristics of unmatched TennCare P & S patients

As shown in Figure 17 on the next page, the majority of TennCare provider-diagnosed P & S syphilis patients were not matched to MHD reported syphilis cases. Overall, 89.7% of the patients were not matched.

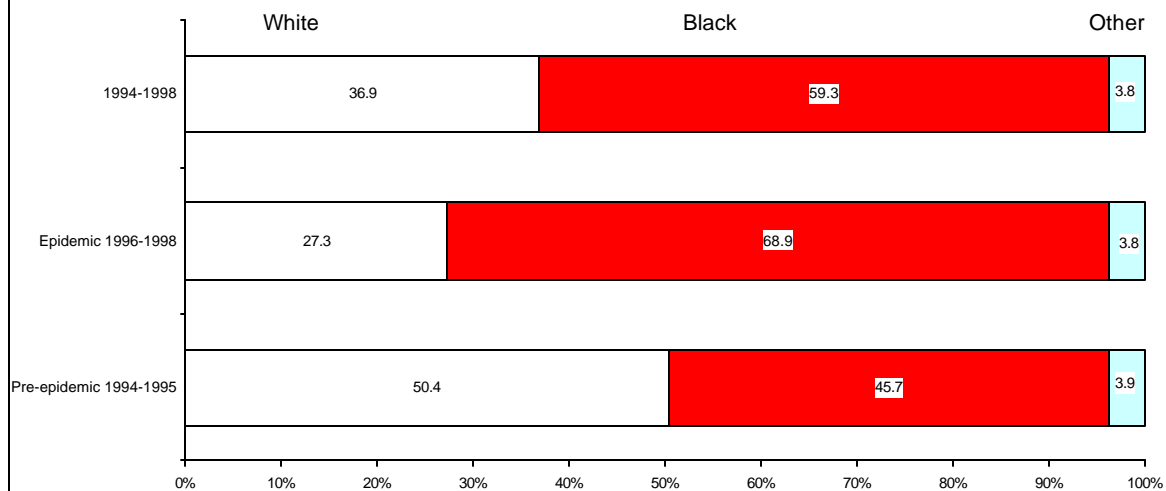
Figure 18 on the next page revealed a racial distribution of unmatched patients during different periods. Overall, among the unmatched patients, 36.9% were whites, 59.3% were blacks, and 3.8% were other races. When examining the data by time period, it was found that while blacks constitute 50.4% of the unmatched patients during the pre-epidemic period, they constitute only 27.3% of the unmatched patients during the epidemic period. While the proportion of black patients decreased from pre-epidemic period to epidemic period, the proportion of white patients increased. The proportion of other race patients decreased slightly from pre-epidemic period to epidemic period.

<sup>14</sup> Considering the difficulty of clinical diagnosis of syphilis, it is reasonable not to expect TennCare providers to make accurate clinical diagnoses of P & S syphilis all the time. Anecdotal data suggests that some providers may make a clinical diagnosis based on a reactive result on any syphilis test. To distinguish TennCare provider-diagnosed P & S syphilis patients from the MHD surveillance system confirmed cases, we used “unmatched patient” for TennCare provider-diagnosed P & S syphilis patients who were not in the MHD confirmed case list. MHD confirmed cases were referred to as “reported case.”

**Figure 17. TennCare P & S Syphilis Patients Matched and Unmatched to MHD Reported Cases, Nashville, TN, 1994-1998**



**Figure 18. Race Distribution of Unmatched P & S Syphilis Patients, Nashville, TN, Pre-Epidemic versus Epidemic Period, 1994-1998**



As displayed in Figure 19 on the next page, overall, 16.0% of unmatched patients were males and 84.0% were females. When examining the gender distribution by different period, it was found that the proportion of male patients decreased from pre-epidemic period to epidemic period, whereas, the proportion of female patients increased.

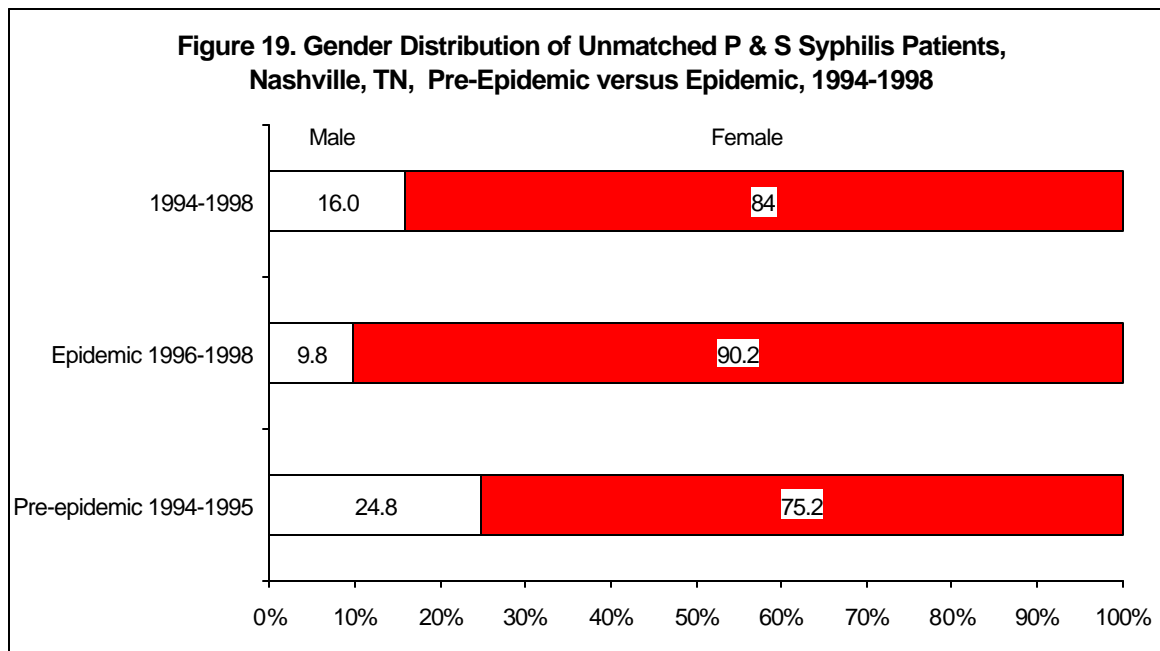


Figure 20 presents the gender distribution by stage of disease for unmatched patients. Overall 12.8% of the unmatched patients were in primary stage and 87.2% were in secondary stage (not depicted in Figure 20). In other words, there were 6.8 times more secondary syphilis patients than primary syphilis patients. Examining the gender ratio in the different stages of disease revealed that for patients at primary stage, the female to male ratio was 1.9, while for patients at secondary stage, the female to male ratio was 6.6. In other words, a very high percentage of secondary syphilis patients were females (86.8%). For the primary stage patients, the percentage difference is less remarkable (females: 65%, males 35%).

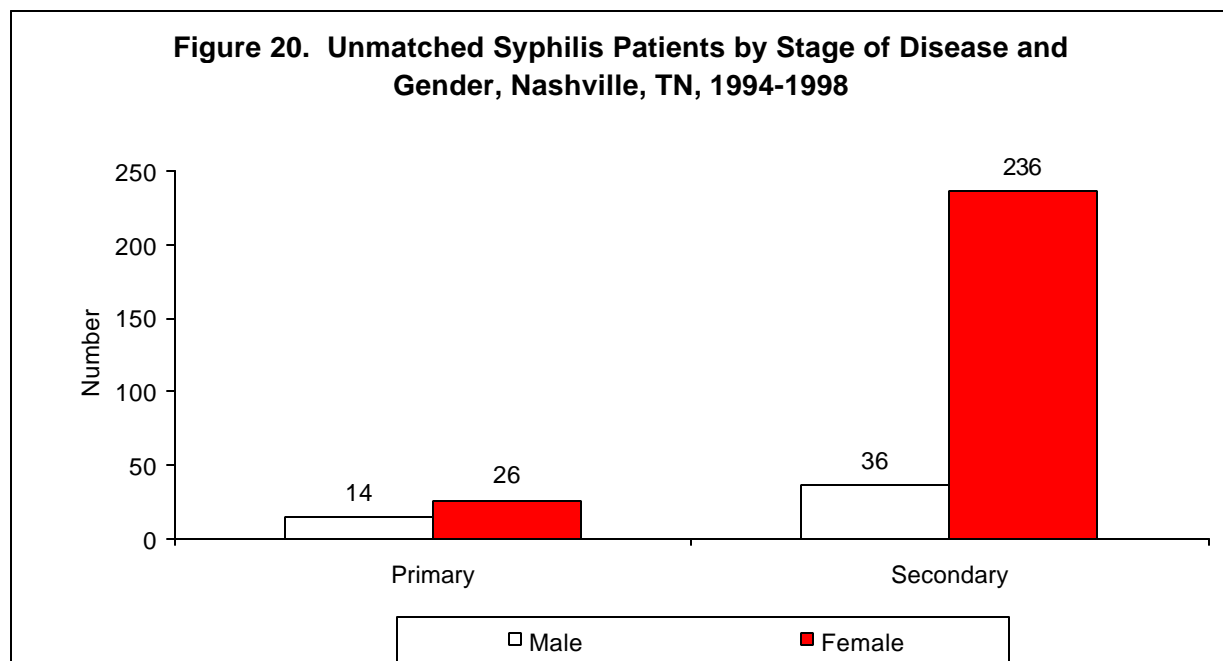
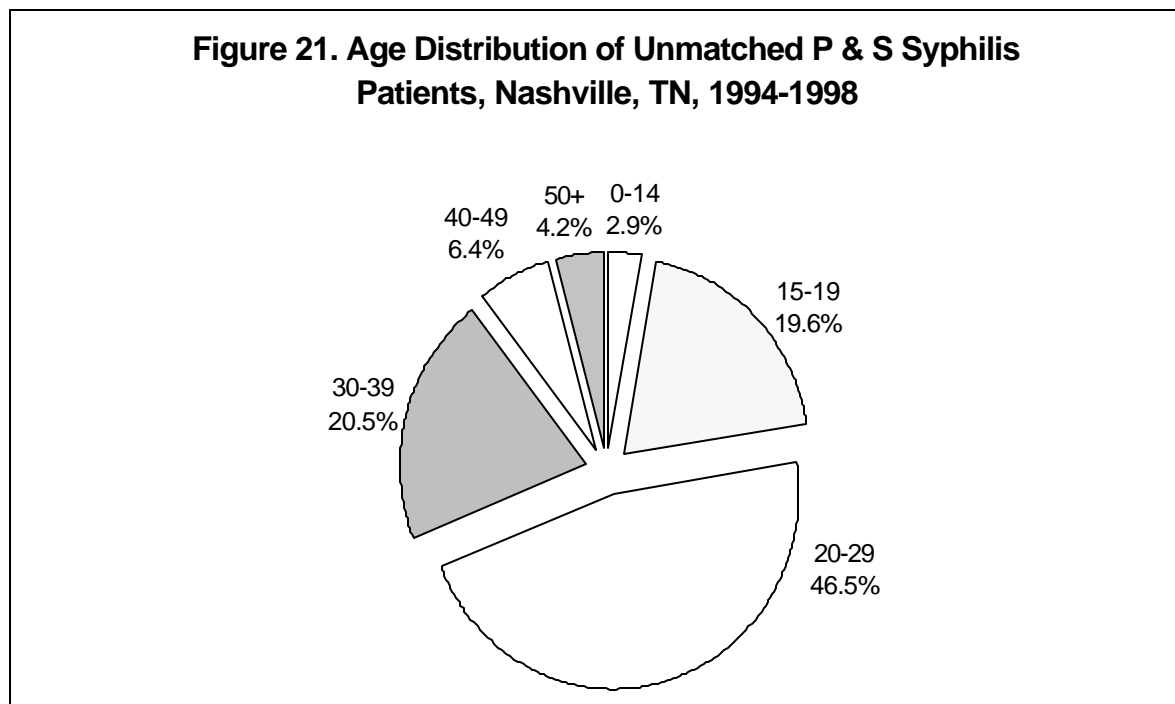




Figure 21 shows the age distribution of unmatched syphilis patients. As can be seen, the 20-29 age group had the highest percentage (46.5%) of unmatched syphilis patients, followed by the 30-39 age group (20.5%). The 15-19 age group had the third highest percentage (19.6%).



c. MHD STD clinic audit results

Table 15 on the next page shows the MHD STD clinic audit results. The records of 43 TennCare provider-diagnosed patients that were originally unmatched to the same year reported P & S syphilis cases were found in the MHD STD clinic system as a result of this audit. The reasons for the records being in the system but not matched to the reported cases are the following: 1) Patient records were for a year other than the TennCare diagnosed year. For example, a 1994 unmatched patient has a record in the MHD STD clinic system as a P & S syphilis case in 1996. 2) Patient records were not included in the confirmed cases list because of negative laboratory results. 3) Patient records were not included in confirmed cases list because of biological false positive<sup>15</sup> results. 4) Patients were diagnosed as early latent syphilis at a later time and reported to MHD.

<sup>15</sup> A biological false positive reaction is defined as a reactive (or positive) serologic test for syphilis which in actuality is not caused by syphilis but from lupus erythematosus, hepatitis, and other conditions (12).

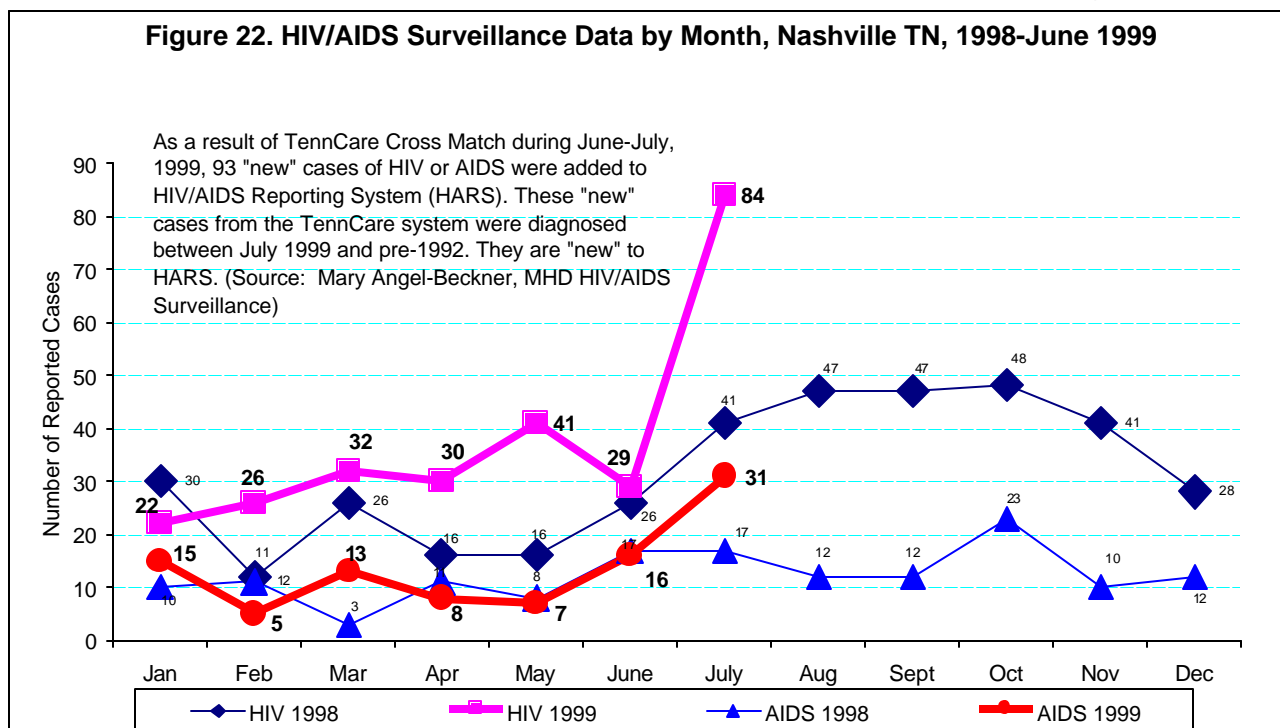
Table 15. MHD Clinic Auditing Results of Unmatched P & S Patients, 1994-1998

Year	TennCare patients unmatched to MHD reported cases	Audit resulted in MHD records of unmatched patients	Reasons for unmatched to MHD reported cases
1994	49	10	<ol style="list-style-type: none"> <li>1. In the MHD system as a case in a year other than TennCare diagnosed year</li> <li>2. Negative laboratory results</li> <li>3. Biological false positive</li> <li>4. Diagnosed as early latent syphilis later and reported to MHD</li> </ol>
1995	80	9	
1996	93	12	
1997	60	10	
1998	30	2	
Total	312	43	

### 3. Discussion:

Syphilis control and prevention consists of targeted screening, clinical diagnosis and treatment, partner notification, and health education. Early recognition and adequate treatment of patients and their sex partners are an essential means of preventing community spread. Rapid investigation of sex partners is critical for bringing persons with early syphilis to treatment before they can spread the infection within the community. Community health education should focus on primary prevention among persons at risk. Educational messages should be targeted based on epidemiological data (8, 41). All of these approaches heavily rely on syphilis surveillance data. It is impossible to control syphilis without a good surveillance system.

Using a cross-match approach to enhance a surveillance system is not new. During June and July of 1999, the Tennessee Department of Health performed a TennCare Matching Study for the HIV and AIDS surveillance system (Figure 22). As a result of the TennCare cross match, 93 "new" cases of HIV or AIDS in Davidson County, TN were identified and added to the Tennessee HIV/AIDS Reporting System.

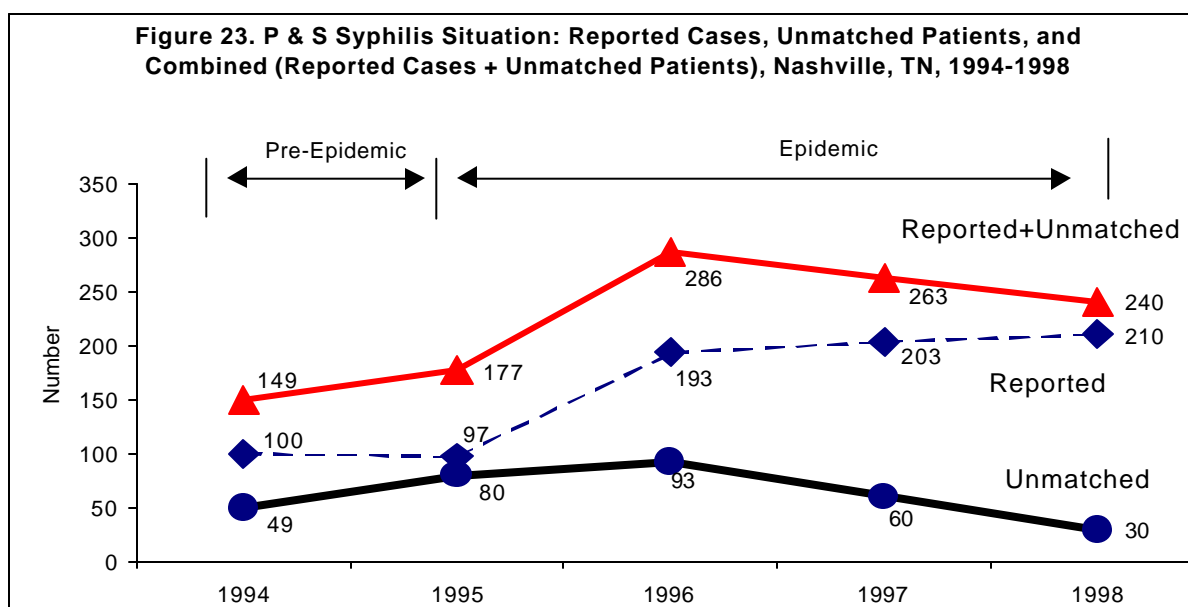


These “new” cases from the TennCare system were diagnosed between the time of the cross match and pre-1992 period. However, they were “new” to the Tennessee HIV/AIDS Reporting System (42).

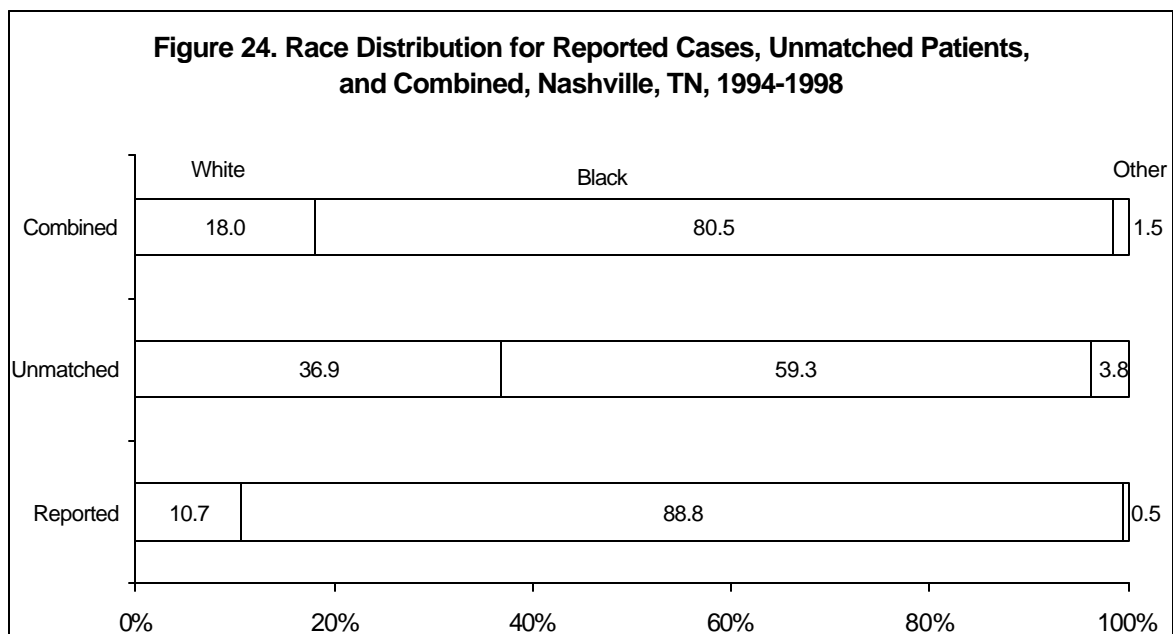
It is important to recognize that positive laboratory tests (EIA or ELISA and Western Blot or indirect IFA) for HIV provide more conclusive evidence for HIV infection than positive serologic tests for syphilis. However, the findings from the TennCare matching study suggest that a systematic examination of the syphilis surveillance system in Nashville is needed.

Several possible impacts on Nashville’s syphilis epidemic profile and syphilis control and prevention strategies due to new findings from the TennCare matching study are presented in the following discussion.

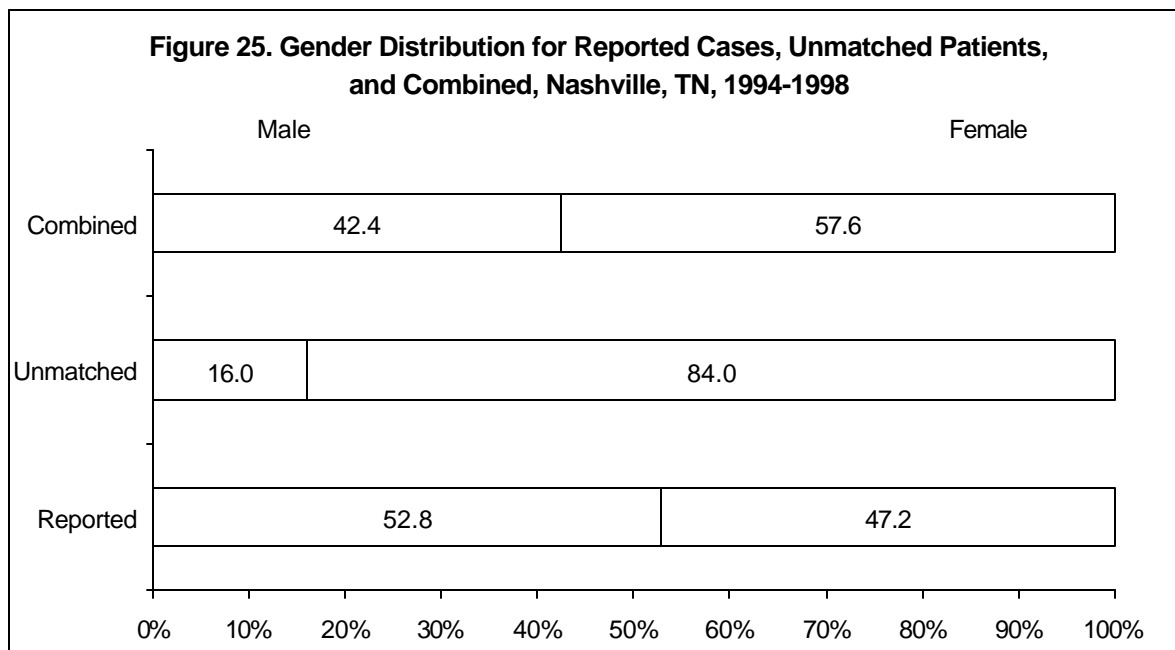
If unmatched TennCare diagnosed P & S syphilis patients were verified as unreported cases, the number of P & S syphilis cases in the current epidemic would be larger than previously reported (Figure 23). Furthermore, the epidemic would have peaked in 1996 if unreported patients were included and began a slow decline in 1997 and 1998, instead of a continuous increase since 1996 as documented in Part One of the report. This may have an impact on overall community syphilis control and planning strategies.



The racial distribution of P & S syphilis would be about 80.5% blacks and 18.0% whites if unmatched patients were included, instead of 88.8% blacks and 10.7% of whites as documented in Part One of the report. This may help the community to re-define a targeted population (Figure 24 on the next page).



The gender distribution of P & S syphilis would change from 47.2% females and 52.8% males to 57.6% females and 42.4% males if unmatched patients were included (Figure 25).



It is particularly noteworthy that 84.0% of the unmatched patients were females, which was noticeably higher than the female population among TennCare enrollees<sup>16</sup>. Of these unmatched female patients, only 9.9% were primary syphilis. Due to biological gender differences, primary syphilis lesions are less likely to be noticed in female patients than in male patients. Primary stage is the most infectious stage of syphilis. The fact that 87.2% of all unmatched patients and 90.1% of unmatched female patients were secondary syphilis may suggest that most of them may have been unknowingly spreading the disease before they sought medical attention.

Because 312 TennCare provider-diagnosed P & S syphilis patients were not in the MHD syphilis surveillance system, it is unknown and also unlikely that proper follow-up and contact tracing/partner notification were conducted, even if all or some of them were actual syphilis cases.

MHD STD Clinic auditing results revealed that several unmatched patients were reported to MHD in the following 1-2 years, suggesting that they were not reported to MHD during the year of diagnosis. Followed up of these unmatched patients is unlikely. Their sexual partners are unlikely to be evaluated and treated. Therefore, these patients and their sexual partners may become a potential source for syphilis transmission in the community.

Several observations suggest that it is likely that unmatched patients may have contributed to the current epidemic. These observations are as follows:

- 1) A high percentage (90.1%) of unmatched female patients were coded as secondary syphilis. This suggests that further investigation is needed to see whether there is a large pool of undiagnosed female primary syphilis patients in this community.
- 2) Syphilis cases in this community tend to engage in high-risk behaviors as documented in Section II of this report. Among 802 P & S syphilis cases reported during 1994-1998, 71.6% had criminal charge/arrest records, 38.9% had drug-related charges, 12.3% had sex-related charges. In total, there were 9,020 criminal charges among 802 cases.
- 3) Literature reports that among couples with frequent sexual contact, four out of five partners exposed to the infectious lesions of early syphilis were infected without preventive measures (22).

In addition, there appears to be a significant number of physicians who do not comply with notifiable disease reporting requirements. The findings from this investigation are consistent with the results from a survey of 158 local physicians conducted by MHD in 1999. The survey found that only 64% of physicians who treat and/or refer treatment for STDs reported results to MHD (43). The survey's findings reaffirms the observation that there is an improvement opportunity in the syphilis

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<sup>16</sup> MHD TennCare Enrollment Program data documented that from 1998 to 2000, among TennCare enrollees aged 14-44, 30.3% were males and 69.7% were females.

surveillance system. The availability of TennCare utilization data presents an avenue for active syphilis surveillance not previously utilized by MHD.

However, it is important to notice that there are many unanswered questions regarding these findings. First, we need to verify the facts. The following questions need to be answered:

- 1) How many of the unmatched TennCare patients were correctly diagnosed and coded as P & S syphilis cases?
- 2) How many of the unmatched TennCare patients were clinically diagnosed cases by providers without appropriate lab tests?
- 3) How many of the unmatched TennCare patients were clinically diagnosed and also ordered lab tests?
- 4) If lab tests were ordered, how many tests were negative?
- 5) If lab results were positive, how many of the lab tests were not reported?
- 6) If lab results were positive and mailed to MHD, how many of the lab results were lost in mail?

By answering the above questions, we should be able to identify several improvement opportunities in syphilis care and/or the syphilis surveillance system for syphilis control and prevention.

A further investigation is in the planning stage to verify if the unmatched patients in the above TennCare study were in fact syphilis cases. If unmatched patients were verified as actual cases, then, we would need to know if underreporting is unique to Nashville. This question can be answered by comparing the TennCare matching data for Davidson County, Shelby County, Knox County, and Hamilton County in Tennessee.

If underreporting is unique to Nashville, then the large number of unreported cases in Nashville may be one of the most important factors causing the Nashville syphilis epidemic. The contribution of these unmatched patients to the current epidemic can then be assessed, using case-contact tracing data and other existing epidemiological data.

Even if underreporting is not unique to Nashville, we have still identified an opportunity to enhance the syphilis surveillance systems in Tennessee's major metropolitan areas.

If the existence of unmatched patients were due to miscoding and/or misdiagnosis, we have identified an opportunity to enhance the syphilis care and data systems in Davidson County, Tennessee.

## V. Public Health Effort

Literature suggests that without preventive measures, three of ten sexual encounters between an infected and an uninfected person will result in the transmission of syphilis (22). Public health interventions to prevent and control syphilis include 1) reducing the probability of infecting a susceptible partner; 2) limiting the number of partners who have sex with infected persons; and 3) reducing the duration of infectiousness (22).

To examine the MHD's effort in preventing and controlling syphilis, MHD Clinic visit data and budget data were obtained and analyzed. First, overall clinical visit data were examined to determine if there was any change in access to health care. Syphilis often occurs in persons and neighborhoods with poor access to health care (24). Then, STD clinical visit data were assessed. The MHD overall budget and communicable disease control budget were also analyzed to assess if there were any budget changes during this period of time and its consequences.

### A. Methods

The 1993-1999 MHD clinic visitation data by patients, services, and programs were obtained from the Tennessee Patient Tracking Billing Management Information System (PTBMIS). The 1993-1999 MHD budget data were obtained from the MHD Bureau of Administrative Support Services. All data were tabulated and analyzed. The results are presented below.

### B. Findings

#### 1. MHD Clinic Visit Data

##### a. Clinic services overview

During 1993-1999, MHD clinics<sup>17</sup> provided 3,763,504 services<sup>18</sup> to 704,807 patients<sup>19</sup> during 1,308,118 visits<sup>20</sup>. Of 704,807 patients, 41.2% were males and 58.8% were females.

From Figure 26 on the next page, it is observed that both the number of clinic patients and number of clinic visits decreased during 1993-1999 (Table 16). During the

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<sup>17</sup> A "clinic" is an establishment or a program within MHD that provides services directly or indirectly to patients. Examples are the STD Clinic, Lentz Health Center, Downtown Service Center, Immunization Program-private physician, Caldwell School Clinic, Healthy Nashville Mobile Unit, TennCare Enrollment Office, Health Promotion, and Chronic Disease Intervention.

<sup>18</sup> A "service" is defined as a complete procedure performed at MHD clinics for a patient. Examples are an HIV antibody test, an STD examination, or an epidemiology interview.

<sup>19</sup> A "patient" is defined as an unduplicated person seen at MHD clinics.

<sup>20</sup> A "visit" is defined as a duplicated count of persons seen at MHD clinics. A person who visits one MHD clinic for immunization service in the morning and another MHD clinic for STD service in the afternoon will be considered as 1 patient and 2 visits.

pre-epidemic period (1993-1995), on average, 551,780 services were provided to 110,677 patients during 193,902 visits at 46 clinics each year. Whereas, during the epidemic period (1996-1999), on average, 527,041 services were provided to 93,194 patients with 181,603 visits at 38 clinics each year.

Compared to the pre-epidemic period, during the epidemic period, the number of patients decreased 15.8%, the number of visits decreased 6.3%, the number of services decreased 4.5%, and the number of clinics decreased 18.0%.

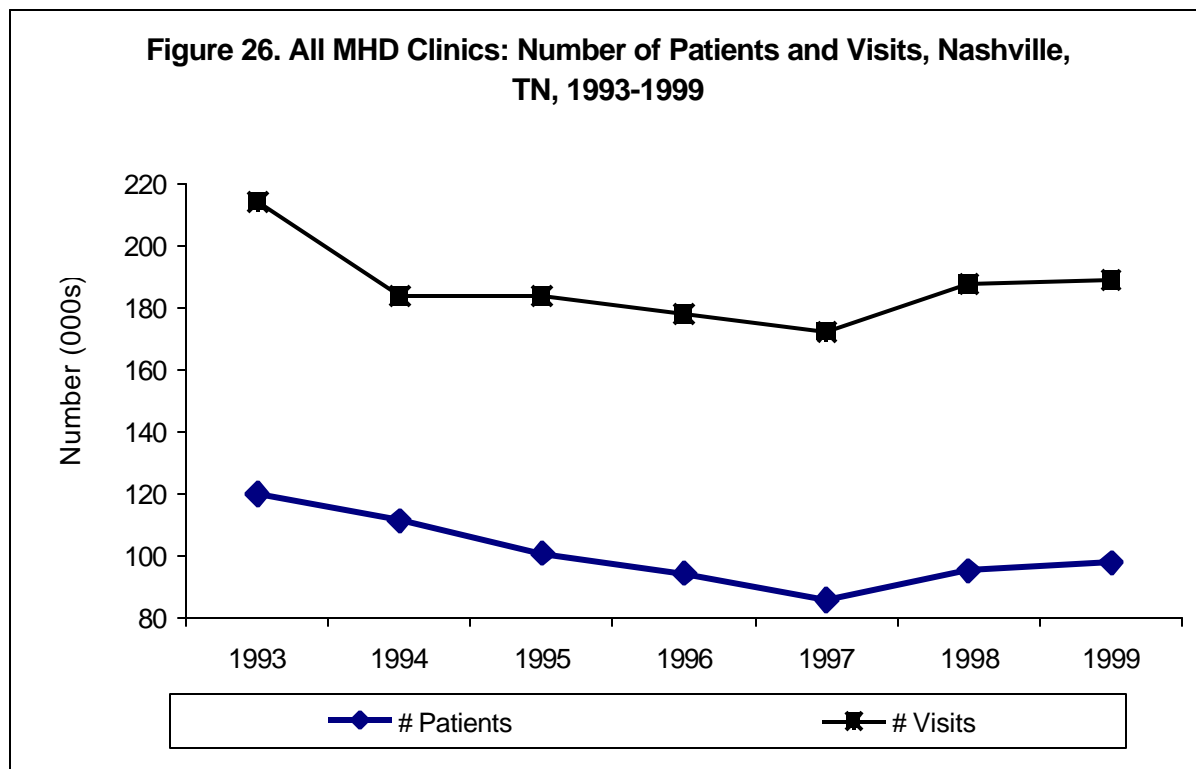


Table 16. MHD: Number of Clinic Patients, Visits, and Services, 1993-1999

	Number of Patients	Number of Visits	Number of Services	Number of Clinics Providing Services
1993	119,932	214,248	564,870	47
1994	111,310	183,607	512,285	48
1995	100,788	183,852	578,185	44
1996	94,351	177,826	619,112	46
1997	85,554	172,314	579,850	41
1998	95,177	187,436	453,154	35
1999	97,695	188,835	456,048	30
Total	704,807	1,308,118	3,763,504	NA

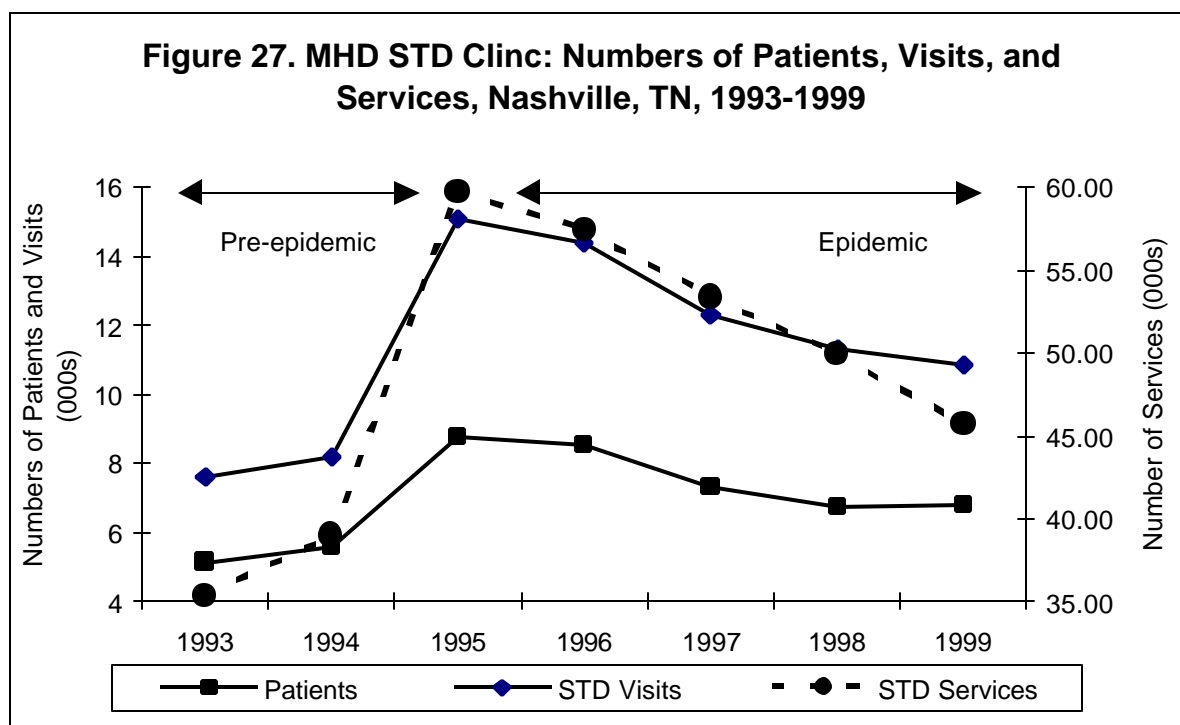
Note: NA = Not Available



b. STD Clinic Services

Further examining MHD STD clinic data, it is found that during 1993-1999, the MHD STD clinics provided 340,647 STD services to 48,881 STD patients with 79,764 STD visits (Table 17 on the next page). Of 48,881 STD patients, 61.7% were males and 38.3% were females. Figure 27 demonstrates an increasing trend of MHD STD Clinic's workload. The number of STD patients increased, as did STD visits, and STD services from 1993 to 1999.

During the pre-epidemic period (1993-1995), on average, 44,711 STD services were provided to 6,498 STD patients with 10,302 STD visits each year. Whereas, during the epidemic period (1996-1999), on average, 51,629 STD services were provided to 7,347 STD patients with 12,215 STD visits each year.

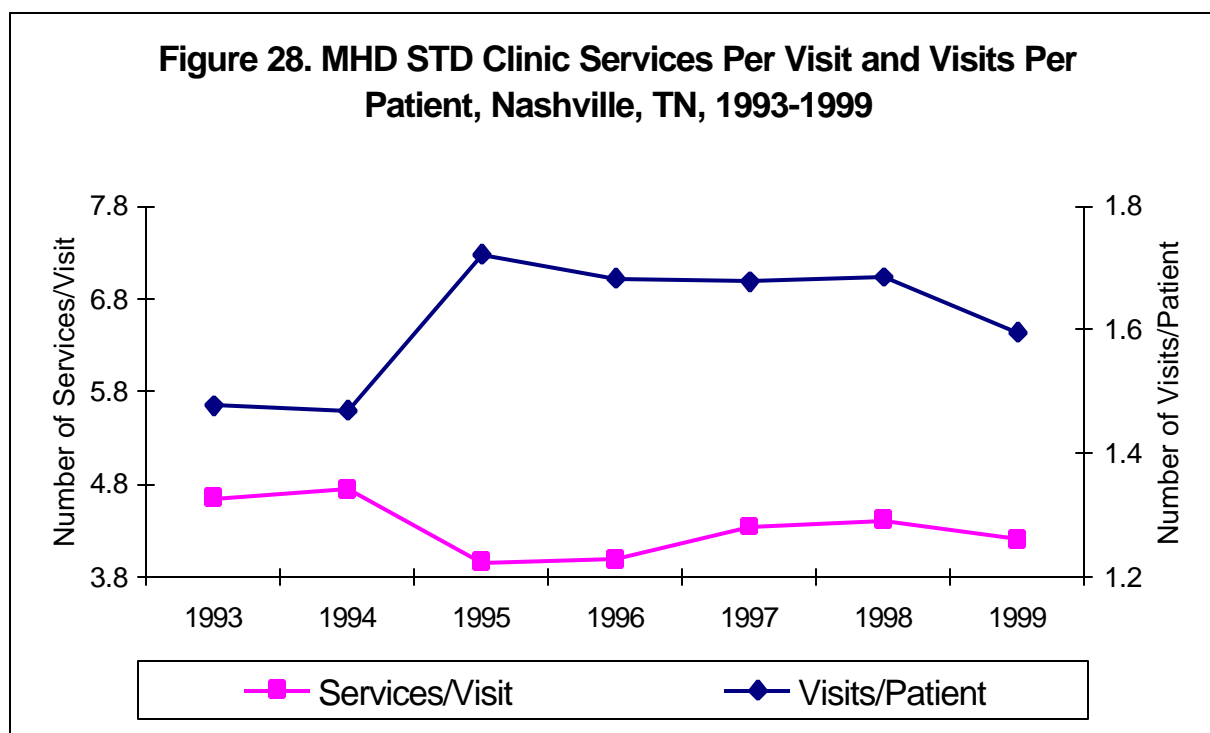


Compared to the pre-epidemic period, during the epidemic period, the number of STD patients increased 13.1%, the number of STD visits increased 18.6%, and the number of STD services increased 15.5%. Also of note is the fact that the percentage increase in number of STD visits (18.6%) is larger than that of STD services (15.5%).

A further look at STD services per visit per year, STD services per patient per year, and STD visits per patient per year supports this observation. Compared to the pre-epidemic period (1993-1995), during the epidemic period (1996-1999), STD services per visit decreased 4.8%, whereas, STD visits per patient increased 6.7%, and STD services per patient increased 2.2%.

Table 17. MHD: Number of STD Patients, STD Visits, and STD Services, 1993-1998

	Number of Patients	Number of STD Visits	Number of STD Services	Services Per Visit	Services Per Patient	Visits Per Patient
1993	5,146	7,603	35,360	4.7	6.9	1.5
1994	5,590	8,213	39,022	4.8	7.0	1.5
1995	8,758	15,089	59,751	4.0	6.8	1.7
1996	8,541	14,381	57,438	4.0	6.7	1.7
1997	7,327	12,297	53,396	4.3	7.3	1.7
1998	6,717	11,323	49,967	4.4	7.4	1.7
1999	6,802	10,858	45,713	4.2	6.7	1.6
Total	48,881	79,764	340,647	NA	NA	NA



Note: NA = Not Available

In summary, MHD's overall clinic services decreased during 1993-1999 in terms of number of patients, visits, and services. For the same time period, MHD STD clinic services needs and demand increased, documented by an increased number of patients and visits. However, the needs and demand may not have been completely met, as was reflected by an increase in visits per patient and a decrease in the number of services per visit (Figure 28).

## 2. MHD Budget Data

The MHD overall budget has decreased by 8.5% over the past 5 years (1995-1999) (Table 18 and Figure 29 on the next page), resulting in a reduction of clinical preventive services. Although the communicable disease program (including STD services) budget

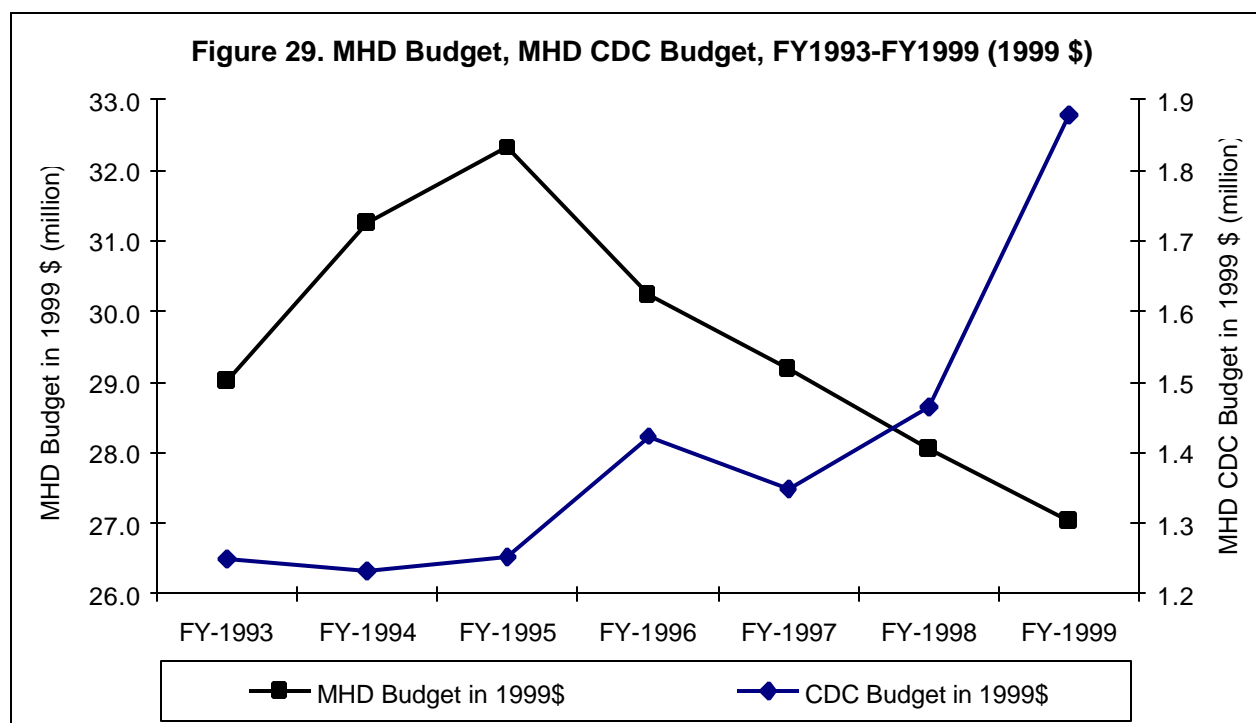
increased noticeably since 1996 (from 3.9% of MHD total budget in Fiscal Year (FY) 1995 to 4.7% in FY 1996, and 7.0% in FY 1999), the overall clinical service reduction is likely to have a negative impact on syphilis prevention and control since many syphilis patients who are asymptomatic are very likely to go non-STD clinics for their clinical services.

As a part of the communicable disease program, budgeting for STD services has remained untouched. One of the six Disease Investigation Specialist positions was eliminated in the STD program in 1993. No additional positions have been eliminated in the STD program during 1994-1998, but no additional positions have been created to better equip public health officials in addressing the syphilis outbreak.

Table 18. MHD Budget, 1995-1999

Fiscal Year (FY)	MHD Budget (\$)	MHD Budget *in 1999 \$	Communicable Disease Control (CDC) Budget** (STD is a part of CDC) (\$)	CDC Budget in 1999 \$	CDC \$ as % of MHD Budget
FY-1993	25,157,498	29,005,115	1,083,009	1,248,646	4.3
FY-1994	27,813,440	31,266,660	1,096,726	1,232,892	3.9
FY-1995	29,562,226	32,316,711	1,146,538	1,253,368	3.9
FY-1996	28,483,130	30,244,037	1,340,622	1,423,503	4.7
FY-1997	28,120,925	29,189,695	1,300,030	1,349,439	4.6
FY-1998	27,447,041	28,053,233	1,431,757	1,463,379	5.2
FY-1999	27,034,372	27,034,372	1,877,919	1,877,919	7.0

Note: \*1999 \$ is converted from actual dollar using a cost of living calculator provided by American Institute of Economic Research (9). \*\* MHD Communicable Disease Control (CDC) budget includes budgets for STD Program, TB Control Program, HIV/AIDS Surveillance, Notifiable Disease Program, and others. The data for each program's budget is not available.



## C. Discussion

In the 1990s, the U.S. public health system for delivering clinical preventive services was drastically over-burdened (44). Nashville was no exception, as documented by decreased clinical services at MHD during 1993-1999. This decrease of public health services to the community has had a significant negative impact on the public's health in Nashville. The decrease of public health service and the increase of syphilis and other sexually transmitted disease cases are not coincidental. Literature has suggested that the occurrence of syphilis is more of a sentinel event that indicates an entire neighborhood is at risk for STDs rather than an event that identifies an individual person at risk (23, 45).

Syphilis often occurs in persons and neighborhoods with poor access to health care. Because the risk of acquiring syphilis is dependent in part on the likelihood that a person's sex partners have received medical care, improvements in access to health care should decrease syphilis rates in an entire community, including persons who do not actually use the services (23). On the other hand, the deterioration in access to health care should increase syphilis rates in an entire community. It is documented that a large proportion of syphilis patients were generally uninsured, engaged in high risk behavior, and relied on public health care sites such as health department clinics for care. It has also been reported that they were unable to receive needed health care in the past because of the cost (23).

As documented on page 53 of this report, MHD overall clinical services underwent a significant change during 1993-1999. In comparison with the pre-epidemic period, the number of patients decreased 15.8%; the number of visits decreased 6.3%; the number of services decreased 4.5%; and the number of clinics decreased 18.0% during the epidemic period. The primary reason the numbers of patients, patient visits, and services have declined is the cessation of providing care for sick patients. When MHD decided not to be a TennCare provider, it consciously walked away from a major source of both revenue and service provision. However, with such a noticeable decrease of clinical services at MHD, it is very likely that a portion of syphilis infected persons remained undetected, untreated, and became members of a small group of "core transmitters" in the community. This is at least partially supported by the evidence of a relatively high level of early latent syphilis in this community.

MHD epidemiological surveillance data found that since 1994, the rate of early latent syphilis<sup>21</sup> in both males and females has followed an upward trend through 1999. Most noticeably, the rate among black males began to increase after 1994 and reached 169 cases per 100,000 in 1999 (36). (Tables 19 and 20, Figure 30 on the next two pages)

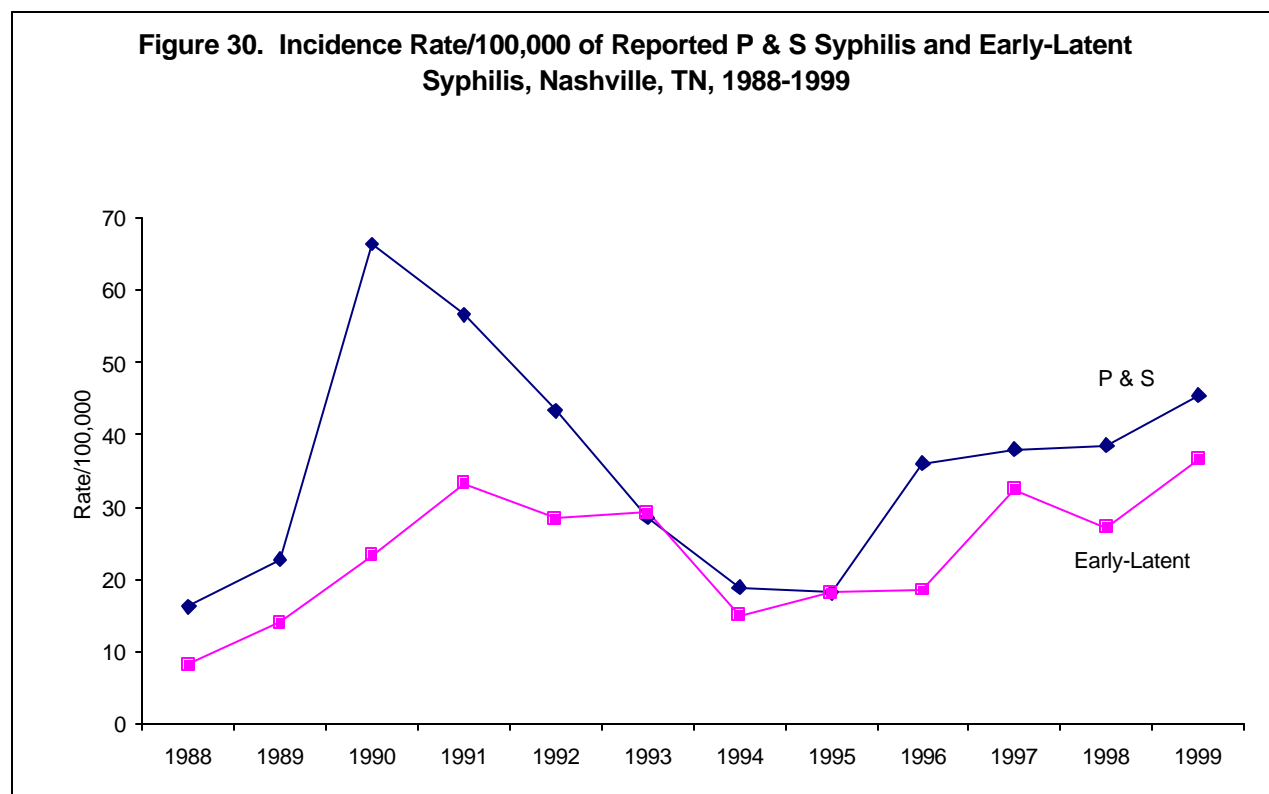
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<sup>21</sup> Early latent syphilis indicates a period of latency within the first year after infection. When there is little or no case-finding activity, it is probable that many infected persons will progress through the primary and secondary stages to latency before being detected (36,46).

Table 19. Number of Reported Early-Latent Syphilis Cases by Gender and Race, Nashville, TN, 1988-1999

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	Total	%
Total	42	72	119	170	147	153	79	97	99	173	148	202	173	1674	100.00
Male	20	43	56	69	75	88	40	61	56	70	85	118	83	864	51.61
Female	22	29	63	101	72	65	39	36	43	103	63	84	90	810	48.39
White	10	9	18	26	18	18	13	12	10	30	18	24	30	236	14.10
White Male	3	5	4	5	11	9	3	5	2	14	4	8	5	78	4.66
White Female	7	4	14	21	7	9	10	7	8	16	14	16	25	158	9.44
Black	32	63	101	144	127	134	66	84	86	136	130	176	137	1416	84.59
Black Male	17	38	52	64	63	79	37	56	52	82	81	108	73	802	47.91
Black Female	15	25	49	80	64	55	29	28	34	54	49	68	64	614	36.68
Other*	0	0	0	0	2	1	0	1	3	7	0	2	6	22	1.31
Other Male	0	0	0	0	1	0	0	0	2	7	0	2	5	17	1.02
Other Female	0	0	0	0	1	1	0	1	1	0	0	0	1	5	0.30

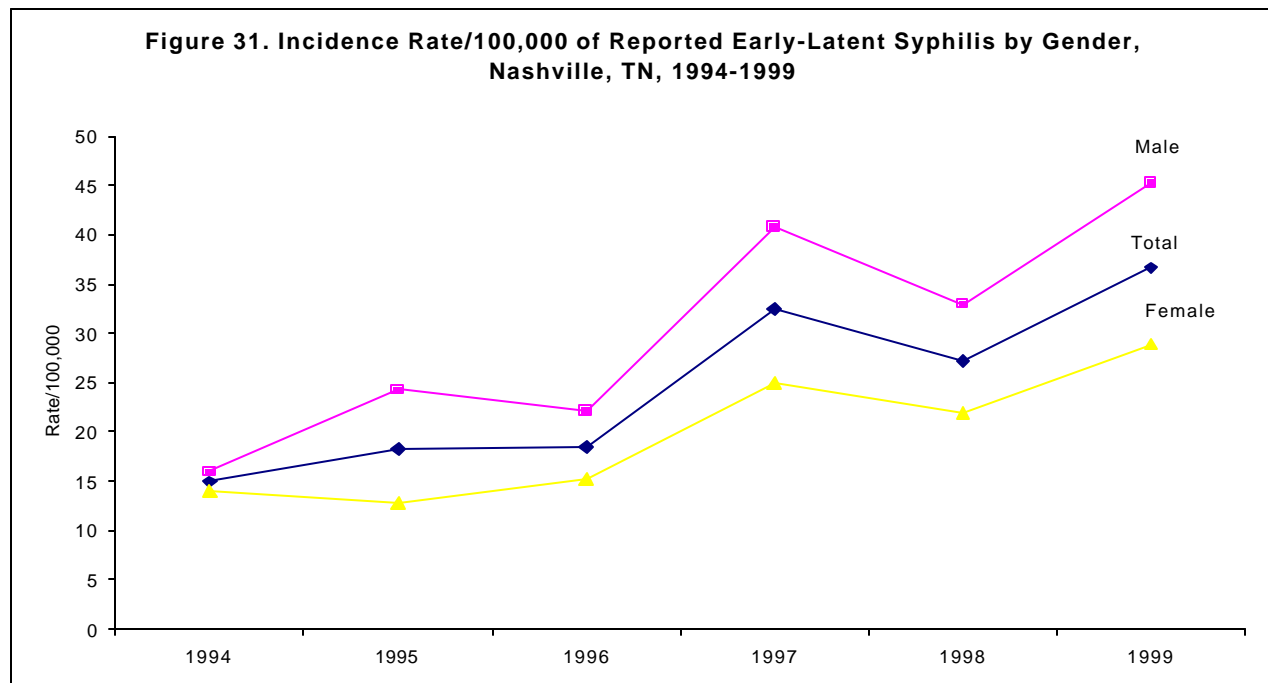
Note: \* Other refers to races that include individuals who are not considered black or white.



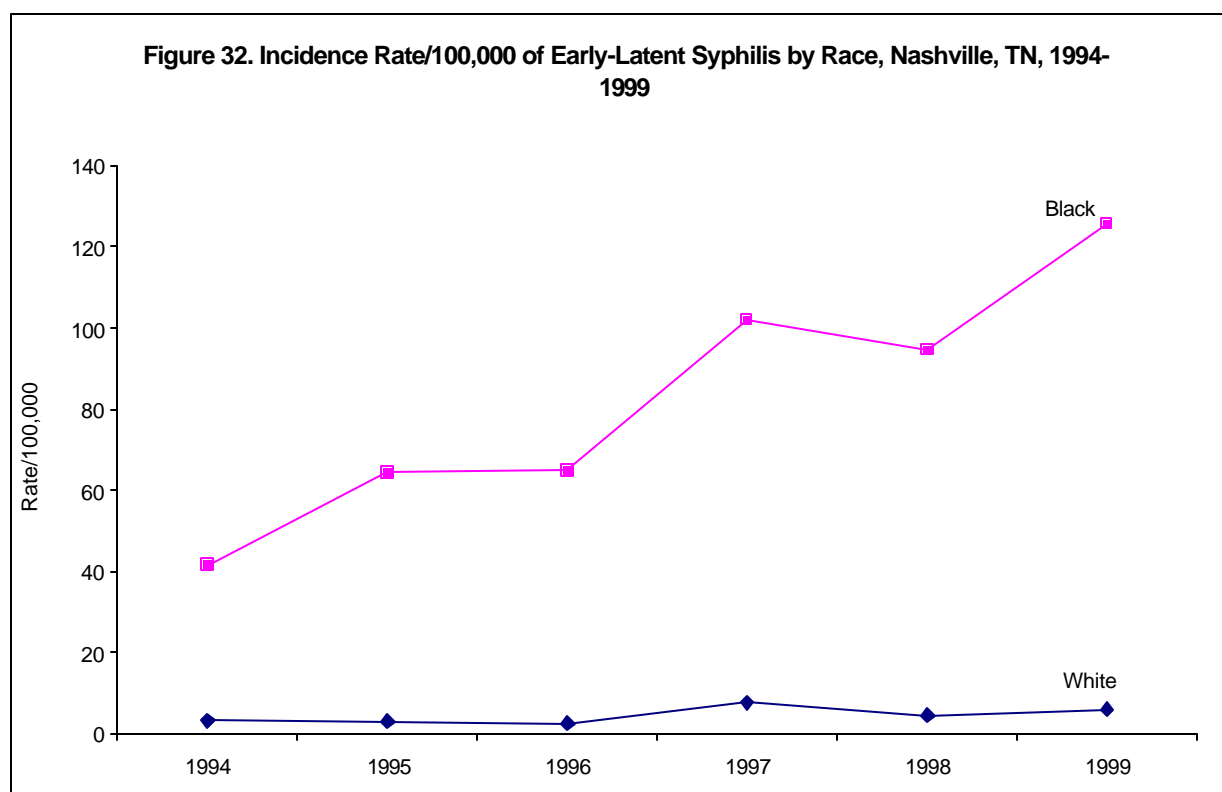
**Table 20. Incidence Rates of Reported Early-Latent Syphilis per 100,000 Persons by Gender and Race, Nashville, TN, 1988-1999**

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Total	8.22	14.10	23.30	33.18	28.42	29.28	14.95	18.22	18.50	32.42	27.14	36.64	31.06
Male	8.25	17.73	23.09	28.38	30.57	35.52	15.98	24.25	22.11	40.78	32.96	45.27	31.53
Female	8.20	10.81	23.48	37.51	26.48	23.65	14.03	12.85	15.26	24.90	21.93	28.91	30.64
White	2.62	2.36	4.72	6.81	4.69	4.66	3.34	3.07	2.55	7.7	4.54	6.01	7.45
White Male	1.64	2.74	2.19	2.74	5.99	4.87	1.61	2.67	1.07	7.52	2.11	4.19	2.60
White Female	3.51	2.01	7.03	10.55	3.49	4.46	4.93	3.43	3.91	7.87	6.76	7.67	11.90
Black	26.83	52.82	84.68	119.12	103.03	106.54	41.41	64.33	64.92	102.00	94.59	125.56	95.91
Black Male	30.94	69.16	94.64	115.08	111.24	136.87	62.88	93.67	85.84	134.64	129.16	169.02	112.22
Black Female	23.32	38.86	76.17	122.56	96.05	80.82	41.71	39.55	47.29	74.55	65.58	89.15	82.27
Other*	0.00	0.00	0.00	0.00	19.74	9.70	0.00	9.34	27.62	64.00	0.00	17.40	51.19
Other Male	0.00	0.00	0.00	0.00	19.39	0.00	0.00	0.00	36.29	126.26	0.00	34.41	84.50
Other Female	0.00	0.00	0.00	0.00	20.21	19.77	0.00	18.98	18.68	0.00	0.00	0.00	17.23

- Note:
1. 1988-1989 incidence rates were calculated using 1990 census population.
  2. 1991-2000 incidence rates were calculated using TDH population projection based on 1990 census population. The data for 1990-1998 were accessed electronically from the TDH STD/HIV Program on 9/20/99, the data for 1999 were accessed on 3/8/2000, and the data for 2000 were accessed on 6/6/2001.
  3. \*Other refers to other races that include individuals who are not considered black or white.



The continuing high number and rate of reported cases of early latent syphilis during 1994-1999 (Figures 31, 32) indicate that some cases may lie hidden for months before finally being diagnosed and treated. This is harmful to the infected individual and dangerous to the public's health for it means that maximum spread likely occurred during primary and secondary stages. Literature has documented that core transmitters not only have large numbers of sex partners but also have sexual contact with a much larger group of persons who have moderately risky sexual behavior (e.g., two to four sex partners per year) (21). Persons who have moderately risky behavior are at high risk for acquiring syphilis if they are associated with each other and to core transmitters in a neighborhood (23).



It is noted that compared to the pre-epidemic period, during the epidemic period, the increase of STD services per patient (2.2%) was not as large as the increase of STD visits per patient (6.7%). This may suggest that STD patients will have to increase their number of visits to the MHD STD clinic to obtain the same number of STD services (Table 17 and Figure 28 on page 55). Therefore, it is reasonable to expect that some patients may turn away from MHD STD clinics, which will result in a missed opportunity for syphilis prevention and control.

The decision of MHD to no longer treat Medicaid/TennCare patients decreased the number of low-income patients coming to the public health department seeking care. This may have inadvertently resulted in persons in the community with undetected and untreated syphilis and other STDs.

When public health services decrease and demands for STD services increase (13.1% increase of STD patients and 18.6% increase of STD visits during the epidemic period in comparison to the pre-epidemic period, see page 54), it is very likely that some patients will turn away from public health facilities. This represents missed opportunities for syphilis prevention and control, which could be a significant contributing factor to the increasing trend of the syphilis epidemic in Nashville.